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BULLETIN

OF THE

TORREY BOTANICAL CLUB

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Vol. 46 No. 8

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TORREY BOTANICAL CLUB

AUGUST, 1919

A new Matonidium from Colorado, with remarks on the distribution of the Matoniaceae

EDWARD W. BERRY

(WITH PLATES 12 AND 13 AND TWO TEXT FIGURES)

In 1916 Professor Cockerell, of the University of Colorado, published a brief note* based upon plant material collected from the supposed McElmo formation of southwestern Colorado. The subsequent discovery that this supposed Lower Cretaceous flora was stratigraphically above a black shale horizon carrying a considerable dicotyledonous flora led to the sending of all of the material to the present writer for a more critical study than Professor Cockerell was able to devote to it.

The discussion of the question of the stratigraphic relations and age of these two floras is reserved for a subsequent communication, the present paper being devoted to the interesting questions of habit and distribution derived from a study of the abundant relics of *Matonidium* preserved in the later of the two floras above mentioned.

The Colorado remains, which Professor Cockerell identified as *Matonidium Althausii*, or *Matonidium Goepperti* as some paleobotanists prefer to call the species on the ground that the older and correct name is less familiar, are superficially very much like that well-known and rather variable species. Botanists who

* A Lower Cretaceous flora in Colorado. Jour. Wash. Acad. Sci. 6: 109–112. *pl. 1, 2.* 1916.

[The BULLETIN for July (46: 235–284) was issued July 31, 1919.]

depreciate specific differentiation and who, like Professor Seward, are more interested in the former distribution of generic types, would not hesitate to refer the Colorado form to *Matonidium Althausii*. Such questions are always difficult, and tastes and temperaments differ with individual workers. One point of view may serve one purpose and the other another. All that need be insisted upon in the present connection is that the framing of loosely defined specific limits as opposed to finely discriminated ones effectually obscures whatever value the fossils may have for the elucidation of geologic chronology or problems of the former time and avenues of migration, and is a method that has gradually become almost obsolete in the allied field of paleozoölogy.

It would seem *a priori* incredible that a single botanical species should range through the Jurassic and Lower Cretaceous and extend over at least two continents in opposite hemispheres; nevertheless it is impossible to differentiate the British Jurassic from the Wealden forms or these from the still younger Russian occurrences, and the specimens referred by Ward to *Matonidium Althausii* from the Albian Fuson formation of the Black Hills* in this country cannot be distinguished from the earlier European occurrences of that species.

Recognizing fully the individual variability in *Matonidium Althausii* and the variation in the form and size of the pinnules from different parts of a single frond, the Colorado *Matonidium* nevertheless presents a number of apparently constant peculiarities that serve to mark it as a slightly but consistently different type. Among these distinctive features might be mentioned the stouter stipe and rachises, the more numerous pinnae, which appear to have been at least twice as numerous as in *Matonidium Althausii*, judging from the frond bases of the latter as figured by Ettingshausen, Schenk and Seward. The pinnae are more slender in the Colorado form and the pinnules are shorter and wider with fewer and more nearly circular or isodiametric sori. For example, in the form of *Matinidium Althausii* described from the Black Hills the falcate slender pinnules are twice as long as in the Colorado material, and each bears about twelve pairs of sori. The Portuguese specimens as figured by Heer† show eighteen pairs of

* Ann. Rep. U. S. Geol. Surv. 19²: 653. *pl. 160, f. 5–8.* 1899.

† Secc. Trab. Geol. Port. 16. *pl. 15, f. 1–6.* 1881.

sori to each pinnule, Schenk's admirable figures* show eight or nine pairs, and they are very numerous in Trautschold's figures of the Russian material.† The most elongate and largest pinnules of the Colorado species bear but five or six sori on the distal half of the lamina and but six or seven on the proximal half, while the most abundant remains are those with short and broad pinnules bearing three sori on their distal halves and four sori on their proximal halves.

I regard these features and others to be mentioned as of specific value and propose that the Colorado specimens be discriminated as

Matonidium americanum sp. nov.

Matonidium Althausii Cockerell, Jour. Wash. Acad. Sci. **6**: 111. *f. 2.* 1916. [Not (Dunker) Ward.]

Cycadospadix? sp. Cockerell, *Idem.* 110. *f. 1.*

This species also includes forms which Cockerell suggested might represent *Todites*, and *Weichselia* or *Cladophlebis*. The equisetaceous stems mentioned as probably representing *Equisetum Burchardti* (Dunker) Brongniart are probably fragments of the large stipes of *Matonidium*. The striations are somewhat irregular and do not alternate at the nodes, there are no traces of nodal sheaths and the apparent jointing appears to be due to shrinkage cracks of a collapsed and consequently furrowed stipe, since a similar state of preservation is seen in the objects that were referred to *Cycadospadix*, which latter are clearly the apical portions of *Matonidium* stipes and only most superficially suggestive of *Cycadospadix*, and strictly comparable with similar remains of *Matonidium Althausii* as figured by Schenk,‡ Ettingshausen§ and Seward.‖

Matonidium americanum may be characterized as follows: Digitate fronds with the same habit as *Matonidium Althausii* or the existing *Matonia pectinata*, with long stout stipes about 1 cm. in diameter as preserved in a partially flattened condition. Stipe surface somewhat regularly furrowed, but whether this was

* Palaeont. **19**: 220. *pl. 27, f. 5; pl. 28, f. 1, 2; pl. 30, f. 3; pl. 42, f. 1.* 1871.

† Nouv. Mém. Sci. Nat. Moscou **13**: 28. *pl. 19, f. 3.* 1870.

‡ Palaeont. **19**: *pl. 42 f. 1.* 1871.

§ Abh. k. k. Geol. Reichs. **13**: *pl. 5. f. 4, 6.* 1854.

‖ Jurassic Fl. **1**: *pl. 11, f. 1.* 1900.

an original feature or is due to collapse during fossilization is undeterminable. Distad the stipe expands into a flabellate recurved or reflexed "collar" which shortly divides to form the axes of the pinnae, whose attitude in life was transverse or reflexed with respect to that of the vertical stipe. These reflexed "collars" are especially common in the rocks and are the objects which Cockerell referred to *Cycadospadix*. They are well shown in PLATE 12, FIGS. 9–12.

The width of the "collar" before it split up into pinnae varies from specimen to specimen and is not always clear, although it is narrowest medianly. No traces of pinnules have been found in actual connection with these stipes although they are in close association. The divisions of the "collars," however, do not terminate as they would if the fossils were of the nature of *Cycadospadix*, and the breaks at the ends are obviously mechanical and not natural. The evidence of their reflexed form is also clear, and the size of the segments, their condition of preservation and furrowing are in exact agreement with the specimens of proximal pinnae axes. The number of pinnae was large but somewhat variable. The "collar" shown in FIG. 9. indicates four lateral pinnae at each end of the collar and thirty-one additional intercalated pinnae, making thirty-nine in all. FIG. 10 shows clear traces of at least twenty-five pinnae, and FIG. 12, which is the counterpart of the apex of the specimen shown in FIG. 11, shows the bases of thirty-six pinnae. The pinnae were therefore much more numerous than the published figures indicate for *Matonidium Althausii* and also somewhat more numerous than the normal number in the modern *Matonia pectinata*. The exact length of the pinnae is unknown since all are preserved in a fragmentary condition, but judging by the fragments of proximal, medial and distal parts preserved, and the size and degree of tapering of the rachises, they could not well have been shorter than 20–25 cm., or about the same length as in the admirable specimen of *Matonidium Althausii* figured by Schenk* from the German Wealden. Their width, however, was much less than in that species, the largest certainly identified (PLATE 12, FIG. 8) being but 11 mm. across, while the more abund-

* Palaeont. **19**: *pl. 28, f. 1.* 1871.

ant remains (PLATE 12, FIG. 2) are about 8 mm. in width. Several sterile fragments which I have referred to this species on the basis of general form and association are somewhat larger (PLATE 12, FIG. 7) being 15 mm. wide. These show a narrower rachis with slightly less obtuse pinnules which are greatly crowded, and may represent fragments of a contemporaneous species of *Cladophlebis*. Fertile fragments of pinnae present a very different appearance when the opposite faces are viewed. From below the rachis appears very stout and the laminae of the pinnules is entirely hidden by the large sori except for a broad band in the position of the midvein. Viewed from above the rachis is much narrower, the pinnules evidently having been inserted near the upper margin of the rachis as shown in the section (PLATE 13, FIG. 4).

The pinnules are short and broad, more or less falcate, obtusely rounded at their tips. All have revolute margins and they are opposite or sub-opposite in position. Their substance is thick and the venation cannot be made out in any of the preserved material. Distad along the rachis the pinnules gradually become shorter and somewhat broader relatively (PLATE 12, FIG. 6), eventually becoming very small and coalescent basally (PLATE 12, FIG. 3, 4), their revolute margins giving them a pointed appearance. Proximad along the rachis the pinnules gradate through short and broad forms to short wide scallops as shown in PLATE 12, FIG. 5.

The sori are in two rows separated by a broad space in the region of the midrib. They diminish in size toward the pinnule tips and are prevailingly circular except where mutual crowding causes the lateral margins to be somewhat flattened. They stand out from the surface of the pinnules as prominent umbos and a pronounced umbilicus on the indusium marks the position of the central soral axis. The indusia are peltate and are intact in all of the Colorado material so that the number of sporangia can not be made out. In *Matonidium Althausii* the sori are said to have been more numerous than in the modern *Matonia pectinata*, sections of a sorus of the latter species being introduced for comparison on PLATE 13, FIGS. 1, 2. In the bulk of the material each pinnule shows three or four upper and four or five lower sori (PLATE 13, FIG. 3). These were the only forms in the collection which Professor Cockerell had labelled *Matonidium Althausii*. In the

largest fruiting material there are six or seven sori on the distal halves of the pinnules and seven or eight on their proximal halves, (PLATE 13, FIG. 6), a less number than in *Matonidium Althausii*, as already remarked. The sori also differ from those of the latter in being isodiametric instead of transversely elongate and more or less rectangular.

The material, which was collected by J. T. Duce, comes from the divide between Cutthroat Gulch and Hovenweep Canyon west of Dolores and is contained in a light somewhat ferruginous sandstone containing little quartz and a great deal of feldspar, and apparently corresponds to what Cross correlated with the Dakota sandstone in the San Juan region of Colorado.

The family Matoniaceae is one of exceptional botanical interest. Its sole existing genus, *Matonia* R. Brown (1830), contains but two known species which differ remarkably in vegetative habit and are both confined to the uplands of the Malay Peninsula and the island of Borneo. The older and only species known up to 1888 was commonly associated with the family Cyatheaceae, although its intermediate character had usually resulted in its being set apart as a special tribe. It has also been associated with the Gleicheniaceae and the Polypodiaceae. Christ (1897) and most subsequent workers have regarded *Matonia* as the sole existing type of a distinct family, and an admirable account of the genus and of some of its fossil relatives was given by Seward in 1899.*

The extinct genus *Matonidium*, to which the Colorado plant is referred, was a characteristic type of the Jurassic and especially of the Lower Cretaceous. Although known as early as 1843 its botanical affinity was first recognized by Schenk in 1871 and it has subsequently been found to have been widespread in the European region and more sparingly represented in the western United States. Most of the occurrences have been referred to the single species *Matonidium Althausii*, although Krasser† has described a well characterized species from the Upper Cretaceous (Cenomanian) rocks of Moravia, which appears to have also been present in rocks of the same age in Bohemia.

* Phil. Trans. Roy. Soc. Lond. **191B**: 171–209. *pl. 17–20.* 1899.

† Beitr. Paläon. Oesterreich-Ungarns **10**: 119. *pl. 11, f. 1; pl. 12, f. 1, 2; pl. 17, f. 10.* 1896.

These occurrences are assembled upon the accompanying sketch map (TEXT FIG. 1) and are shown within the enclosed areas in Europe and North America. The area of distribution of the two existing species of *Matonia* is shown on the map in solid black. A second rather well-known extinct genus belonging to this family is the genus *Laccopteris*, which was founded by Presl in 1838. *Laccopteris* was especially characteristic of the late Triassic and hence was considerably older in its inception than *Matonidium*. Its relationship with *Matonia* was first clearly defined by Zeiller*

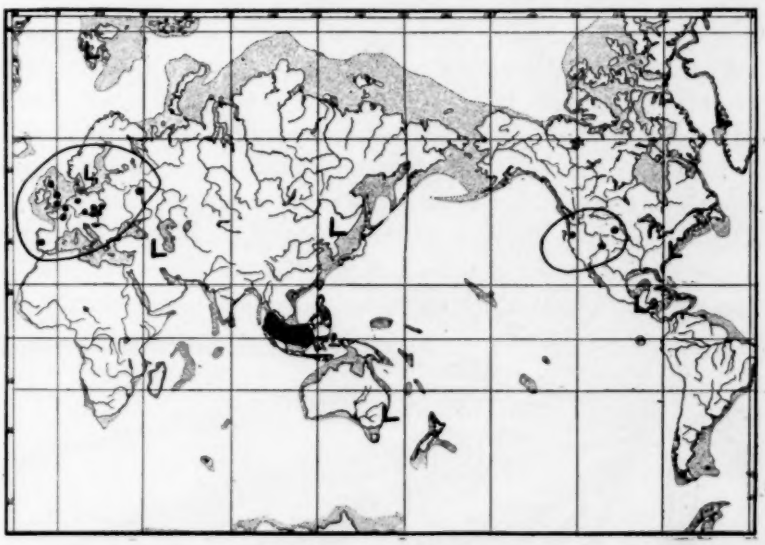

FIG. 1. Sketch map showing the area of distribution of the two existing species of *Matonia* (solid black), the fossil occurrences of *Matonidium* (black disks within the enclosed areas), and the fossil occurrences of *Laccopteris* where they do not coincide with occurrences of *Matonidium* (L).

in 1885. Reference to the accompanying map (TEXT FIG. 1), where the occurrences of *Laccopteris* are indicated by L, shows that it greatly extends the Mesozoic range of the family and gives the Matoniaceae representation in the far north (Greenland and Spitzbergen), in the Asiatic region and in Australia. Other and less well known fossil genera which have been referred to the Matoniaceae include *Phlebopteris* Brongniart, *Microdictyon* Saporta and *Knowltonella* Berry.

* Bull. Soc. Bot. France **32**: 22. 1885.

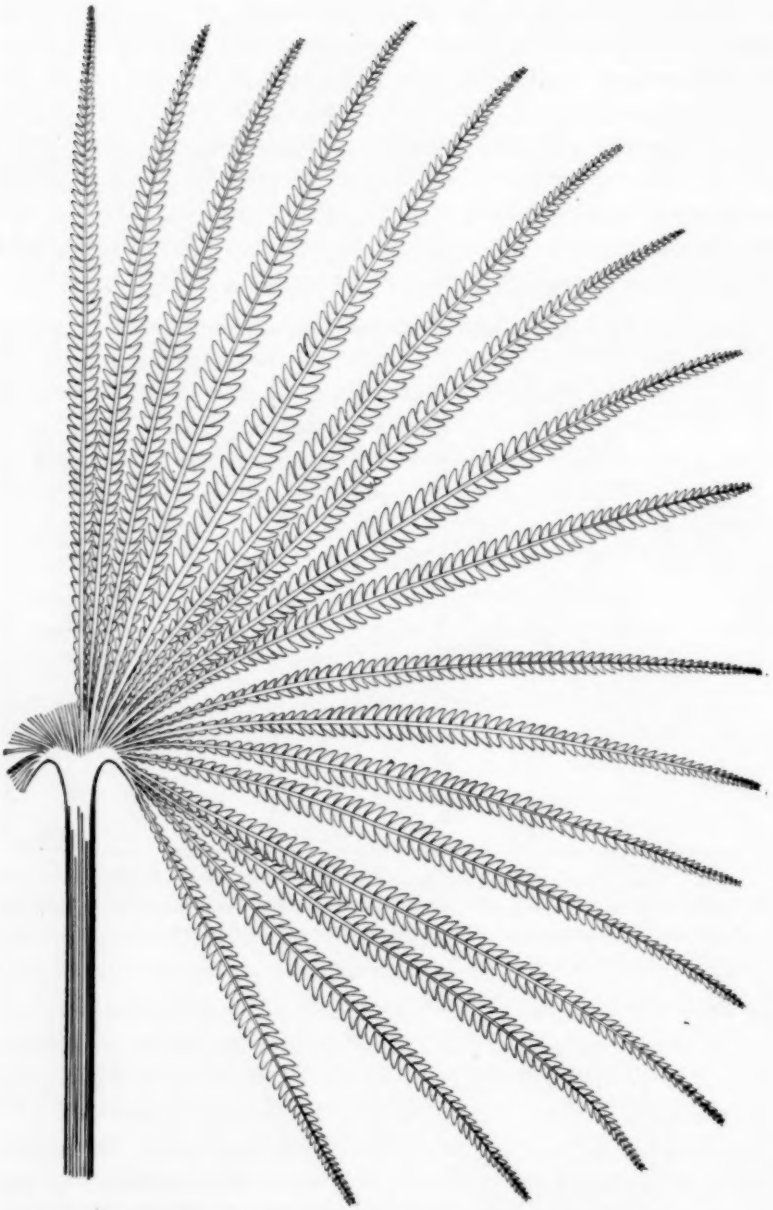

FIG. 2. Restoration of *Matonidium americanum* Berry, two fifths natural size.

The accompanying restoration of *Matonidium americanum*, shown in TEXT FIG. 2, is based upon a considerable amount of material which, although fragmentary, supplies data for all parts of the frond. Its abundance in the small collection from this one locality would seem to indicate that the species was gregarious, sending up its stout stipes from a creeping rhizome as does the modern *Matonia pectinata*. The reduced figure was made from a life size drawing made by plotting the various fragments of the different parts to scale, and the arrangement of the pinnae is based upon their disposition in *Matonia pectinata* and the evidence derived from the numerous fossil frond bases ("collars") preserved. Whether the stipe in the fossil species was as elongated as in the modern *Matonia pectinata* is not known. At the apex the stipe of *Matonidium americanum* was less distinctly dichotomous with less scirpoid branches than in *Matonia pectinata*, one side of the stipe becoming concave and the whole forming a reflexed fan-like base from which the rachises of the numerous pinnae proceded. In life these were not upright as in the restoration but were turned back ninety degrees or more giving the fronds an almost peltate appearance.

Explanation of plates 12 and 13

PLATE 12

MATONIDIUM AMERICANUM Berry

FIG. 1. Under side of fertile pinna showing stout furrowed rachis.
FIG. 2. Under side of fertile pinna showing normal size and form.
FIG. 3. Upper side of apical portion of pinna.
FIG. 4. Portion of same, × 10.
FIG. 5. Basal part of pinna from below.
FIG. 6. Upper part of pinna from above.
FIG. 7. Maximum size of rare occurrence, from above.
FIG. 8. Fragment from below showing maximum development of sori.
FIG. 9. Apex of stipe showing indications of 39 pinnae.
FIG. 10. Apex of stipe with 25 pinnae.
FIG. 11. Apex of stipe of another specimen.
FIG. 12. Counterpart of apex of specimen shown in 11 with indications of 36 pinnae.

PLATE 13

FIGS. 1, 2. MATONIA PECTINATA R. Br.

FIG. 1. Lamina and sorus in vertical section showing indusium (black) and sporangia.
FIG. 2. Sorus in transverse section showing central pillar and sporangia with annuli.

FIGS. 3–6. MATONIDIUM AMERICANUM Berry

FIG. 3. Two pinnules of normal form from below to show form and position of sori, × 10.
FIG. 4. Same in longitudinal vertical section, × 10.
FIG. 5. A single pinnule in transverse section showing sori and revolute margins, × 10.
FIG. 6. Two pinnules of the large form with maximum number of sori, from below, × 10.

Phytogeographical notes on the Rocky Mountain region VIII. Distribution of the Montane plants

P. A. Rydberg

The Montane Zone or Pine Belt of the Rocky Mountain region includes approximately the areas between the altitudes of 2,500 and 3,000 m. in southern Colorado, between 1,800 and 2,500 m. in southern Montana, and between 1,200 and 1,800 m. in Alberta, where the Canadian Pacific Railroad crosses the mountains. A general description of the Zone has been given in a previous article.*

The Subalpine Zone of the Rockies comes in contact with the Hudsonian or Eastern Subarctic Zone along the foothills of the Rockies from the headwaters of the Peace River northward, and here the species of the East and of the Rockies more or less intermingle. But the relation between the Montane Zone of the Rockies and the Canadian or Eastern Boreal Zone is very different, for the latter, in its typical development, reaches its western limits in the region of the Lake of the Woods and Lake Winnipeg. The most representative species of the Canadian Zone, *Strobus Strobus* and *Pinus resinosa*, reach their northwestern limits in this region and it is only in the transition belt between the Canadian and Hudsonian Zones, which extends along the height of land between the Saskatchewan and Athabasca Rivers, that species of the Canadian Zone range farther west. This transition belt is characterized by mixed woods of *Pinus Banksiana*, belonging to the Canadian, and of spruces and larches belonging to the Hudsonian Zone. North of the upper Athabasca River and Beaver River practically the whole country is Hudsonian, while south of the northern branch of the Saskatchewan the prairies and the plains begin. These latter grassland formations belong to the Transition or Sub-boreal Zone.

The number of plants common to the Canadian Zone of the East and the Montane Zone of the Rockies is small, outside of

* See Bull. Torrey Club 42: 11–25. 1915.

the common transcontinental species that grow along the watercourses and species which are common to the Hudsonian-Subalpine Zone and the Canadian-Montane Zone. None of the conifers are common to the two regions, and among the trees which occur in common we find only a few species of *Salix*, *Populus*, and *Betula*. If we consider the relationship between the Montane plants of the Rockies and those of the Pacific Coast Mountains, however, we find the conditions quite different. The Cascade Mountains are directly connected with the Rockies in the north and there are several mountain chains interposed between the Cascades and the Rockies in British Columbia, separated from one another only by narrow river-valleys. The Montane Zone of the Cascades, therefore, is practically continuous with that of the Rocky Mountains, and the two regions have many plants in common, the leading conifers not excluded. Many of the Pacific species have emigrated into the Rocky Mountains, especially into the northern Rockies, and many Rocky Mountain species into the Cascades.

As has already been pointed out in earlier articles of mine, the Rockies may be divided into two principal parts, the Northern Rockies, extending from the Yukon Territory to northern Wyoming, and the Southern Rockies, of southern Wyoming, Colorado and northern New Mexico. Each of these main divisions may be subdivided, and the following districts may be distinguished:

Northern Rockies

1. Canadian Rockies
2. Main Range, Montana
3. Selkirk-Bitterroot District
4. Belt Mountains District
5. Yellowstone District
6. Sawtooth District
7. Big Horn District
8. Black Hills District

Southern Rockies

9. Main Range District
10. Uintah-Wasatch District
11. Sevier District
12. La Sal-Abajo District

The main range of the Northern Rockies north of Butte, Montana, is rather homogeneous and the change in the Montane flora seen in proceeding northward is rather gradual, although many of the high northern species found in the Canadian Rockies (District 1) are not found in Montana.

South of Butte the main range (District 2) becomes lower and less distinctly Montane until the neighborhood of Yellowstone Park is reached. Here it rises higher and the Alpine Zone is present in the Bear Tooth, Shoshone, Teton, Gros Ventre, and

Wind River Ranges. This region may be regarded as a distinct subdivision (District 5).

Numerous species belonging to the Cascade Mountains have invaded the Selkirk Mountains in British Columbia and the Bitterroot Mountains between Idaho and Montana, and the flora here has become more or less Pacific in its character. This region (District 3) includes also more or less the western slopes of the main range in British Columbia and northern Montana.

The mountains of Central Idaho, such as the Sawtooth, Salmon River, and other ranges (District 6) are characterized in the Montane Zone rather by the lack of many species found in the main range than by the introduction of any considerable new element. In the Submontane Zone, however, the character of the flora apparently is more like that of the mountains of the Great Basin than that of the main range, although the flora of this region is not so well known as might be desired.

The isolated mountains of central Montana, such as the Belt Mountains, the Snowy Mountains, the Crazy Mountains, and the Little Rocky Mountains, together with the Cypress Hills in Canada (District 4), being rather low, are characterized by a meagre Montane flora without any additional element. This can also be said of the Big Horn Mountains of Wyoming (District 7), although these are much higher and contain a few strictly endemic species.

The Black Hills of South Dakota and Wyoming are also to be counted as a subdivision of the Northern Rockies (District 8), although they contain quite a number of species belonging to the Southern Rockies as well as many belonging to the Canadian and Alleghanian Zones.

In the Southern Rockies the main range (District 9) includes all of the mountains in Colorado and northern New Mexico, together with the Sierra Madre, Medicine Bow, and Laramie Ranges in Wyoming. Only a few peaks of the latter reach the Montane Zone.

The Uintah and the northern part of the Wasatch Mountains in Utah (District 10), although geologically belonging to the Northern Rockies, have a flora closely resembling that of the Southern Rockies. In the Wasatch Mountains, however, there

are found quite a number of species which have immigrated from the Northern Rockies or from the mountains of the Great Basin. The southern part of the Wasatch Mountains, including the Sevier Range, the Henry Mountains, and other ranges west of the Colorado of the West (District 11), have a flora characteristic of the Basin Mountains. The Montane flora consists to a great extent of species common to the Rockies, the Basin Mountains, and the Sierra Nevada. The La Sal and Abajo Mountains, in Southeastern Utah (District 12) have a mountain flora almost the same as that characteristic of the main range of the Southern Rockies in Colorado.

The plants of the Montane Zone of the Rocky Mountains may be classified in the following categories. These are practically the same as those in the Subalpine Zone, with, however, some modification.

I. Transcontinental Species.
II. Species common to the Rockies and the Canadian Zone of the East.
III. Species common to the Rockies and the Pacific Mountains.
IV. Endemic species.

I. Transcontinental Species

The transcontinental species, as well as most of those common to the Rockies and to the East, consist partly of forest species, most of which have migrated around the Saskatchewan Plains, partly of water, meadow, and thicket species which have followed the watercourses across the plains. The former consist to a great extent of species common to the Subalpine and Montane Zones in the Rockies and hence also to the Hudsonian and Canadian Zones of the East; the latter consist mostly of species found also in the Submontane and Transition (or Alleghanian) Zones. Many of the water and bog plants, however, are not found on the plains and hence must have followed the woods.

A. Transcontinental species ranging throughout the Rockies

Here I have included species which are found in the main ranges of both the Northern and Southern Rockies. Many of

these may be lacking in one or more of the districts or subdivisions, especially in Districts 8, 11, and 12, but some also in Districts 4, 6, and 7.

1. PLANTS WITH BOREAL-SYLVAN DISTRIBUTION

In this discussion the word "sylvan" applied to a plant does not mean that it grows only in the deep woods, but that its distribution has taken place in connection with the Northern Woods, and that it does not grow in the prairie or plains regions. The plant may be a forest species in the true sense or it may grow in open woods, thickets, or among rocks in more open places. The essential point is that its migration east or west has taken place around and north of the plains, and not across them along the watercourses. To this category belong the transcontinental trees and most of the shrubs. The most important of the former is the quaking aspen, *Populus tremuloides*, also found in the Subalpine Zone.

In this and subsequent lists, species which are marked "**" are rare in the Southern Rockies; those marked "†" attain their best development at higher altitudes and reach the Alpine zone; those marked "‡" develop best lower down and reach the plains; those followed by "(Eur.)" are found also in Europe and usually also in northern Asia. The nomenclature is that of the author's Flora.*

a. Forest species

Trees

Populus tremuloides
*Populus balsamifera***
Salix Bebbiana
*Betula papyrifera***

Shrubs

Juniperus sibirica (Eur.)
Dasiphora fruticosa (Eur.)
Chamaepericlymenum candense
Lepargyraea canadensis
Arctostaphylos Uva-ursi (Eur.)
Linnaea americana
Distegia involucrata

* Flora of The Rocky Mountains and Adjacent Plains. New York. 1917.

Herbs

Phleum alpinum (Eur.)
Avena striata
Danthonia spicata
Poa compressa (Eur.)
Allium sibiricum (Asia)
Lysiella obtusata
Peramium decipiens
Cytherea bulbosa (Eur.)
Corallorrhiza multiflora
Tium alpinum (Eur.)
Chamaenerium spicatum (Eur.)
Heracleum lanatum
Moneses uniflora (Eur.)
Pyrola uliginosa
*Pyrola asarifolia***
Pyrola chlorantha (Eur.)
Pyrola elliptica
Erxlebenia minor (Eur.)
Ramischia secunda (Eur.)
Monotropa uniflora
Veronica serpyllifolia (Eur.)
Galium boreale (Eur.)
Galium triflorum
Specularia perfoliata
Botrychium Lunaria (Eur.)
Botrychium virginianum (Eur.)
*Botrychium silaifolium***
Filix bulbifera
Filix fragilis (Eur.)
Filix montana (Eur.)
Polystichum Lonchitis
Thelypteris Dryopteris (Eur.)
Asplenium septentrionale (Eur.)
Asplenium Trichomanes (Eur.)
Pteris aquilina (Eur.)
Cryptogramma acrostichoides

b. Aquatic and bog species

The following water and bog plants probably reached the Rockies by the way of the Northern Woods:

Shrubs

Salix chlorophylla
Betula glandulosa

Herbs

Sparganium minimum (Eur.)
Triglochin palustris (Eur.)
Calamagrostis Langsdorfii (Eur.)
Deschampsia caespitosa
Catabrosa aquatica (Eur.)
Panicularia nervata
Panicularia borealis
Panicularia septentrionalis
Eriophorum angustifolium (Eur.)
Scirpus pauciflorus (Eur.)
Scirpus caespitosus (Eur.)
Carex diandra (Eur.)†
Carex gynocrates (Eur.)
Carex disperma (Eur.)
Carex canescens (Eur.)
Carex brunnescens (Eur.)
Carex paupercula (Eur.)
Carex aquatilis (Eur.)
Bistorta vivipara (Eur.)†
Alsine borealis

Sagina saginoides (Eur.)
Thalictrum alpinum (Eur.)†
Batrachium flaccidum (Eur.)
Ranunculus reptans
Cardamine pennsylvanica
Subularia aquatica (Eur.)
Epilobium alpinum (Eur.)†
Epilobium Hornemannii (Eur.)†
Mimulus moschatus
Limosella aquatica (Eur.)
Limosella tenuifolia (Eur.)
Veronica Wormskjoldii†
Elephantella groenlandica
Senecio pauciflorus
Lycopodium annotinum (Eur.)

c. Various mesophytes

A few plants which are neither aquatics nor forest species have invaded the Rockies from the north. These are species that grow among bushes, among rocks, or on hillsides.

Torresia odorata (Eur.)
Calamagrostis purpurascens
Poa crocata
Festuca rubra (Eur.)
Bromus ciliatus
Carex praticola
Carex concinna
Carex Halleri (Eur.)
Juncoides parviflorum (Eur.)
Juncoides intermedium
Juncoides spicatum (Eur.)†
Blitum capitatum (Eur.)
Moehringia latifolia (Eur.)
Moehringia macrophylla
Viola adunca

2. PLANTS WITH RIPARIAN OR CAMPESTRIAN DISTRIBUTION

These plants have crossed the continent over the plains, following mostly the watercourses. All of them are found in the foothills also and most of them attain their best development on the plains and prairies.

a. Aquatic plants

Sparganium angustifolium‡
Potamogeton natans (Eur.)‡
Potamogeton alpinus (Eur.)‡
Potamogeton lucens (Eur.)‡
Potamogeton foliosus‡
Triglochin maritima (Eur.)
Alisma brevipes
Sagittaria latifolia‡
Phragmites Phragmites (Eur.)‡
Panicularia grandis‡
Eleocharis palustris (Eur.)‡
Eleocharis acicularis (Eur.)‡
Eriophorum gracile (Eur.)‡
Scirpus validus‡
Lemna trisulca (Eur.)‡
Lemna minor (Eur.)‡
Persicaria coccinea‡
Batrachium trichophyllum (Eur.)‡

Batrachium Drouetii (Eur.)‡
Ranunculus Purshii‡
Sisymbrium Nasturtium-aquaticum (Eur.)‡
Tillaeastrum aquaticum (Eur.)‡
Callitriche palustris (Eur.)‡
Callitriche autumnalis (Eur.)‡
Hippuris vulgaris (Eur.)‡
Sium cicutaefolium‡
Menyanthes trifoliata (Eur.)‡
Veronica americana‡
Utricularia vulgaris (Eur.)‡
Utricularia minor (Eur.)‡

b. Bog and wet meadow plants

Tree

Salix cordata

Herbs

Phalaris arundinacea (Eur.)‡
Alopecurus aristulatus‡
Calamagrostis elongata‡
Calamagrostis canadensis‡
Beckmannia erucaeformis‡
Carex leptalea (Eur.)
Carex aurea‡
Carex Buxbaumii (Eur.)‡
Carex lanuginosa
Carex viridula‡
Carex rostrata‡
Carex retrorsa‡
Rumex occidentalis
Rumex mexicanus
Ranunculus sceleratus (Eur.)
Halerpestes Cymbalaria‡
Argentina Anserina (Eur.)‡
Gnaphalium uliginosum (Eur.)
Equisetum arvense (Eur.)

c. Meadow plants

Agrostis hyemalis‡
Muhlenbergia Richardsonis
Poa annua (Eur.)‡
Poa triflora (Eur.)‡
Poa pratensis (Eur.)‡
Festuca octoflora‡
Hordeum jubatum‡
Carex stenophylla‡
Carex interior
Juncus bufonius (Eur.)‡
Polygonum ramosissimum‡
Capnodes aureum‡
Arabis ovata‡
Draba nemorosa‡
Viola nephrophylla‡
Viola septentrionalis‡
Artemisia biennis

To this category belong also some of the escaped cultivated plants and common weeds, such as

Phleum pratense (Eur.)‡
Dactylis glomerata (Eur.)‡
Syntherisma Ischaemum (Eur.)
Chenopodium Botrys (Eur.)‡
Bursa Bursa-pastoris (Eur.)‡
Carum Carui (Eur.)‡
Plantago major (Eur.)‡

d. Hillside plants

Panicum Huachucae
Ibidium strictum
Polygonum Douglasii
Bilderdykia Convolvulus (Eur.)
Pulsatilla ludoviciana

B. TRANSCONTINENTAL SPECIES RESTRICTED TO THE NORTHERN ROCKIES

Nearly all of the transcontinental plants restricted in their distribution to the Northern Rockies are of boreal-sylvan distribution, whether they are forest species or not. In spreading across the continent, they have followed the northern woods around the plains north of the Saskatchewan and then south in the mountains. In some cases the species have not extended very far south—have not even entered the United States; in other words, their distribution in the Rockies is limited to District 1, the Canadian Rockies. Others have traveled farther south and invaded District 2, or even Districts 3 and 4. About one third have spread further south into District 5 and from there to Districts 6, 7 and 8. Two are even found in the Uintah-Wasatch District of the Southern Rockies.

1. SPECIES REACHING AT LEAST THE YELLOWSTONE DISTRICT

a. Forest plants

Sabina horizontalis
Melica Smithii
Oryzopsis pungens
Carex Peckii
Streptopus amplexifolius
Rosa acicularis (Asia)
Osmorrhiza divaricata
Androsace septentrionalis (Eur.)
Valeriana septentrionalis
Aster major
Aster Lindleyanus
Youngia nana (Asia)†
Aspidium viride (Eur.)

b. Water and bog plants

Eriophorum Scheuchzeri (Eur.)†
Eriophorum Chamissonis (Eur.)†
Carex livida
Juncus Richardsonianus
Comarum palustre (Eur.)
Equisetum palustre (Eur.)
Equisetum fluviatile
Equisetum laevigatum

c. Cliff plant

Antiphylla oppositifolia (Eur.)†

Of these species *Oryzopsis pungens*, *Carex Peckii*, *Osmorrhiza divaricata* and *Juncus Richardsonianus* have extended their range into the Black Hills of South Dakota, and *Osmorrhiza divaricata* and *Youngia nana* into the Uintah Mountains of Utah.

2. SPECIES REACHING THE MAIN RANGE IN MONTANA OR THE BITTER-ROOTS IN IDAHO, BUT NOT FURTHER SOUTH

a. Forest plants

Actaea rubra
Ribes Hudsonianum
Dryopteris Filix-mas (Eur.)
Dryopteris dilatata (Eur.)
Lycopodium obscurum (Eur.)
Lycopodium complanatum (Eur.)
Lycopodium clavatum (Eur.)
Lycopodium sitchense

b. Water and bog plants

Shrubs

Salix pedicellaris
Salix candida

Herbs

Rynchospora alba (Eur.)
Scirpus subterminalis
Scirpus atrocinctus
Carex vaginata (Eur.)
Carex limosa (Eur.)
Carex scirpoidea (Eur.)
Carex lacustris (Eur.)
Carex Crawfordii
Carex flava (Eur.)
Castalia Leibergii
Drosera rotundifolia (Eur.)
Drosera longifolia (Eur.)
Geum macrophyllum
Mertensia paniculata
Equisetum sylvaticum (Eur.)
Equisetum scirpoides (Eur.)
Lycopodium inundatum (Eur.)

Pellaea glabella, growing among exposed rocks, has a peculiar distribution. Though it is not found in the Southern Rockies it is found in the Black Hills and the hilly country of western Nebraska and reappears in eastern Kansas.

3. SPECIES LIMITED TO THE CANADIAN ROCKIES

a. Forest species

Carex aenea
Carex durifolia
Cypripedium passerinum
Lysias orbiculata
Ophrys convallarioides
Comandra livida
Coptis trifoliata (Eur.)
Thelypteris Phegopteris (Eur.)
Dryopteris fragrans (Eur.)
Woodsia glabella (Eur.)
Lycopodium alpinum (Eur.)

b. Water and bog plants

Herbs

Eriophorum callitrix (Eur.)
Eriophorum opacum (Eur.)
Scirpus pumilus†
Carex chordorrhiza
Carex militaris
Carex deflexa
Oxycoccus Oxycoccus (Eur.)
Oxycoccus macrocarpus

II. Species common to the Rockies and the Canadian Zone

The plants common to the Rockies and to the Canadian Zone of the East consist either of eastern species, whose ranges extend west into the Rockies, or of Rocky Mountain species which have invaded the East. The distribution of the former in the Rockies is very similar to that of the transcontinental species just treated. Some of them have followed the northern woods, others the watercourses across the plains. The distribution area of some reaches the Southern Rockies, while that of others stops in northern Wyoming, in northern Montana, or in the Canadian Rockies. Among the Rocky Mountain species which have emigrated east, some have reached the Lake Superior region, while others are found as far east as the Gaspé Peninsula of Quebec.

A. EASTERN SPECIES, EXTENDING SOUTH INTO THE SOUTHERN ROCKIES

1. Plants of boreal-sylvan distribution

a. Forest species

Oryzopsis asperifolia
Agrostis oreophila
Cinna latifolia (Eur.)
Carex Parryana†
Vagnera stellata
Coeloglossum bracteatum
Peramium ophoides
Corallorrhiza Corallorrhiza (Eur.)

Claytonia virginica
Ranunculus micranthus
Fragaria americana
Rubus pubescens
Viola Selkirkii
Viola renifolia
Viola canadensis
Circaea alpina (Eur.)
Aralia nudicaulis
Prunella vulgaris (Eur.)
Clinopodium vulgare (Eur.)
Pedicularis canadensis
Linnaea americana
Erigeron droebachiensis (Eur.)
Botrychium simplex (Eur.)
Botrychium neglectum (Eur.)
Cryptogramma Stelleri
Selaginella selaginoides

b. Water and bog plants

Alsine alpestris (Eur.)
Alsine crassifolia
Parnassia parviflora
Geum rivale (Eur.)
Viola palustris (Eur.)
Epilobium adenocaulon
Petasites sagittata
Nabalus racemosa
Lactuca spicata
Equisetum pratense (Eur.)

2. EASTERN PLANTS WITH RIPARIAN OR CAMPESTRIAN DISTRIBUTION

Muhlenbergia racemosa
Juncus Vaseyi
Carex lanuginosa
Urtica gracilis
Carex siccata
Thalictrum dasycarpum
Lepidium densiflorum†
Sullivantia Hapemanii
Vicia trifida
Vicia americana
Apocynum androsaemifolium
Macrocalyx Nyctelea‡
Plantago eriopoda‡
Rudbeckia hirta

Vitis riparia, *Juncus Torreyi*, and *Asplenium platyneuron*, eastern species, have reached the Southern Rockies in Colorado, but are not found in the Northern.

3. PLANTS OF THE GREAT PLAINS

Some of the plants of the Great Plains extend up into the Montane Zone. Although they do not belong to the Canadian or Alleghanian Zones of the eastern United States, they are immigrants from the East and may be included here.

Calamagrostis micrantha
Polygonum buxiforme
Xanthoxalis Bushii
Viola pedatifida
Anogra latifolia
Anogra coronopifolia
Plantago Purshii
Laciniaria punctata
Chrysopsis villosa
Solidago glaberrima
Equisetum variegatum

B. EASTERN SPECIES, EXTENDING INTO THE NORTHERN ROCKIES ONLY

1. SPECIES REACHING AT LEAST THE YELLOWSTONE REGION

Carex Richardsonii
Carex eburnea
Heuchera hispida
Phaca americana
Hedysarum americanum

Of these, *Heuchera hispida* and *Phaca americana* even reach the Black Hills and western Nebraska.

2. SPECIES EXTENDING ONLY TO NORTHERN MONTANA OR IDAHO

Carex tenera
Carex pedunculata
Parnassia palustris (Eur.)
Mitella nuda
Chiogenes hispidula
Melampyrum lineare
Thelypteris Robertiana (Eur.)
Dryopteris cristata (Eur.)

3. SPECIES LIMITED TO THE CANADIAN ROCKIES

Trees

Picea canadensis
Picea mariana

Shrub

Salix pellita

Herbs

Carex atratiformis
Vagnera trifoliata
Coptidium lapponicum (Eur.)
Ribes glandulosum
Geum perincisum
Primula mistassinica
Petasites palmata
Pteretis nodulosa
Dryopteris intermedia

Of these, *Picea canadensis* and *Pteretis nodulosa* are found also in the Black Hills.

C. ROCKY MOUNTAIN SPECIES WHICH HAVE EMIGRATED EASTWARD

The following plants have extended their ranges as far east as eastern Minnesota, western Ontario, upper Michigan or Hudson Bay.

Shrubs

Rosa Bourgeauiana
Amelanchier alnifolia

Herbs

Viola rugulosa
Monarda menthaefolia
Androsace subumbellata
Aster laevis
Aster Wilsonii
Solidago pulcherrima
Erigeron glabellus

Another species, *Dryas Drummondii*, has even reached the Gaspé Peninsula, Quebec.

III. Species common to the Rockies and the Pacific Mountains

A. Species found in both the Northern and Southern Rockies, as well as the Cascades and the Sierras

a. Forest species

Nearly all of the plants belonging in this category have passed from the Rockies to the Pacific Mountains, or vice versa, in the north where the two mountain systems are connected, and not across the Great Basin.

Trees

Pseudotsuga mucronata
Pinus Murrayana
Apinus flexilis
Salix Scouleriana

Shrubs

Odostemon Aquifolium
Ribes viscosissimum
Rubacer parviflorum
Echinopanax horridum
Pachystima Myrsinites
Gaultheria humifusa
Vaccinium scoparium

Herbs

Oryzopsis Bloomeri
Festuca subulata
Elymus glaucus
Carex Bolanderi
Carex athrostachya
Veratrum speciosum
Vagnera amplexicaulis
Vagnera lilacina
Trillium ovatum
Piperia unalaschensis
Ranunculus Douglasii
Ranunculus Bongardii
Actaea arguta
Thalictrum sparsiflorum
Aquilegia coerulea
Osmorrhiza obtusa
Pectianthia pentandra
Fragaria bracteata
Geranium viscosissimum
Geranium Richardsonii

Linum Lewisii
*Circaea pacifica**
Glycosma occidentalis
Chimaphila occidentalis
Pyrola picta
Pterospora Andromedea
Androsace filiformis (Asia)
Polemonium occidentale
Collinsia parviflora
Pedicularis racemosa
Achillea lanulosa
Artemisia frigida (Asia)
Arnica cordifolia
Senecio pseudaureus
Hieracium albiflorum
Athyrium alpestre (Eur.)
Athyrium cyclosorum (Eur.)
Cryptogramma densa
Polypodium hesperium

Cryptogramma densa, *Athyrium alpestre*, and *Osmorrhiza obtusa* reappear eastward on the Gaspé Peninsula, Quebec. When their distribution in Canada becomes better known, they may prove to belong among the transcontinental plants. *Thalictrum sparsiflorum* extends east to the Hudson Bay, *Elymus glaucus* to Upper Michigan, and *Collinsia parviflora* and *Achillea lanulosa* to western Ontario; *Echinopanax horridum* is found near the shores of Lake Superior.

b. Water and bog plants

In this class have also been included many plants of the wetter meadows and copses; in other words, the class consists of plants which probably have spread along the watercourses. This means, in this case, mostly along the Columbia River and its tributaries, for the Frazer River drains mostly the Cascades and other ranges west of the Rockies. Only the headwaters of this stream are in the Rocky Mountains, though north of the region here considered and mainly within the Subarctic Zone. The Colorado of the West runs for hundreds of miles in a deep canyon, does not touch the Sierras, and therefore can play practically no part in the distribution of the Montane plants.

Shrubs

Salix glaucops
Alnus tenuifolia
Kalmia microphylla

Herbs

Muhlenbergia comata‡
Muhlenbergia filiformis
Agrostis grandis
Agrostis asperifolia‡

Agrostis variabilis
Graphephorum Brandegei
Danthonia californica
Danthonia unispicata
Carex Raynoldsii
Carex tenuirostris
Carex simulata
Carex athrostachya
Carex Kelloggii
Lemna gibba (Eur.)
Juncus Mertensianus
Iris missouriensis
Polygonum Watsonii
Bistorta bistortoides†
Claytonia lanceolata
Crunocallis Chamissonis
Alsine strictiflora
Alsine laeta†
Alsine calycantha
Nymphaea polysepala
Thalictrum sparsiflorum (Asia)
Myosurus aristatus
Ranunculus Eschscholtzii
Campe americana‡
Parnassia fimbriata
Micranthes arguta
Geum oregonense
Vicia oregana‡
Vicia sparsiflora‡
Epilobium brevistylum
Epilobium occidentale
Amarella strictiflora
Mimulus Langsdorfii
Mimulus Lewisii‡
Pedicularis bracteosa
Galium subbiflorum
Aster occidentalis
Aster Burkei
Erigeron salsuginosus
Rudbeckia occidentalis
Senecio triangularis
Arnica longifolia
Agoseris elata

Of these, some have spread also to the East, as *Crunocallis Chamissonis* and *Galium subbiflorum* to Minnesota, *Linum Lewisii* to the Black Hills and Nebraska, *Alsine strictiflora* to Ontario, and *Thalictrum sparsiflorum* and *Alsine laeta* to Hudson Bay.

c. Various mesophytes

In this category are included plants that grow in open places, as dry meadows, table-land, hillsides and cliffs. Many of these grow also at lower altitudes; in the foothills and even on the plains. Many are also common to the mountain chains of the Great Basin.

Trees or shrubs

Cercocarpus ledifolius
Limnobotrya montigena

Herbs

Eriocoma hymenoides‡
Poa longiligula
Poa Sandbergii
Hesperochloa Kingii‡
Agropyron Smithii‡
Elymus condensatus‡
Carex Douglasii‡
Carex Hoodii
Carex phaeocephala†
Carex obtusata (Eur.)
Carex Rossii
Juncus longistylis
Juncoides comosum
Eriogonum stellatum
Eriogonum umbellatum
Eriogonum ovalifolum
Polygonum sawatchense
Sarcobatus vermiculatus‡
Eurotia lanata‡
Lewisia redeviva
Oreobroma pygmaea
Cerastium strictum (Eur.)
Arenaria congesta†
Arenaria Burkei‡
Anemone globosa
Draba lutea (Eur.)
Arabis retrofracta
Sedum stenosepalum
Lithophragma bulbifera
Lithophragma parviflora
Petrophytum caespitosum
Potentilla Bakeri
Potentilla diversifolia
Drymocallis glandulosa
Lupinus tenellus
Lupinus argenteus‡
Viola venosa
Viola linguaefolia
Epilobium paniculatum‡
Gayophytum intermedium
Gayophytum ramosissimum
Gayophytum racemosum
Oenothera Hookeri
Lavauxia flava
Leptodactylon pungens
Leptodactylon Nutallii
Gilia aggregata
Collomia linearis
Hydrophyllum capitatum
Lappula floribunda
Cryptantha Torreyana
Pentstemon procerus
Castilleja linariaefolia
Campanula petiolata
Macronema suffruticosum
Aster campestris
Antennaria rosea
Antennaria oblanceolata
Gymnolomia multiflora‡
Balsamorrhiza sagittata
Wyethia amplexicaulis
Helianthus petiolaris‡
Madia glomerata
Chaenactis Douglasii
Artemisia incompta
Artemisia tridentata‡
Arnica pedunculata
Arnica fulgens
Agoseris laciniata
Woodsia oregana
Woodsia scopulina

Of these *Eriocoma hymenoides*, *Juncus longistylis*, *Arabis retrofracta*, *Lithophragma bulbifera*, *L. parviflora*, *Petrophytum caespitosum*, *Drymocallis glandulosa*, *Epilobium paniculatum*, *Arnica pedunculata*, and *A. fulgens* extend as far east as South Dakota and Nebraska; *Gilia aggregata* extends to Minnesota, reappearing farther east on the Gaspé Peninsula; *Carex Rossii* and *Draba lutea* to upper Michigan; *Woodsia scopulina* and *W. oregana* are found on the Gaspé Peninsula.

B. ROCKY MOUNTAIN SPECIES FOUND IN BOTH SOUTHERN AND NORTHERN ROCKIES, WHICH HAVE SPREAD INTO THE CASCADES, BUT ARE NOT FOUND IN SIERRA NEVADA

a. Forest species

Tree

Picea Engelmannii

Shrubs

Sorbus scopulina
Rubus melanolasius

Herbs

Calamagrostis luxurians
Carex Geyeri
Ophrys nephrophylla
Razoumofskia americana
Razoumofskia Douglasii
Atragene columbiana
Ozomelis stauropetala
Conioselinum scopulorum
Ligusticum tenuifolium
Apocynum ambigens
Aster Geyeri
Erigeron macranthus
Erigeron speciosus
Erigeron conspicuus

b. Water and bog plants

Shrub

Salix exigua

Herbs

Poa leptocoma
Poa interior
Poa Olneyæ
Agrostis humilis
Agrostis idahoensis
Limnorchis stricta
Limnorchis borealis
Limnorchis viridiflora
Ibidium porrifolium
Alsine obtusa
Ranunculus alismaefolius
Ranunculus cardiophyllus‡
Trollius albiflorus
Delphinium multiflorum
Argentina argentea
Dodecatheon parviflorum
Castilleja exilis
Graphalium sulphurescens

Of these *Argentina argentea* extends east to South Dakota and *Ranunculus cardiophyllus* to eastern Saskatchewan.

c. Various mesophytes

Melica spectabilis
Melica bella
Bromus polyanthus
Carex nubicola
Carex pachystachya
Carex Geyeri
Carex filifolia‡
Carex scopulorum
Anticlea elegans
Juncus confusus
Allium Geyeri
Delphinium Nelsonii
Thlaspi Nuttallii
Draba nitida
Peritoma serrulatum
Leptasea austromontana
Potentilla Nuttallii
Drymocallis corymbosa
Sieversia grisea
Sieversia ciliata
Thermopsis montana
Lupinus caespitosus
Astragalus striatus
Astragalus goniatus
Viola vallicola
Phlox caespitosa
Gilia pulchella
Phacelia sericea
Castilleja lancifolia
Castilleja lauta
Castilleja hispida
Orthocarpus luteus
Coleosanthus grandiflorus
Aster apricus
Antennaria flavescens
Antennaria concinna
Atnennaria corymbosa
Antennaria pulcherrima
Antennaria anaphaloides
Artemisia Michauxiana
Artemisia cana‡
Artemisia arbuscula
Artemisia tripartita
Arnica Parryi
Arnica mollis
Arnica Rydbergii
Senecio serra
Selaginella densa

Of these, *Delphinium Nelsonii*, *Anticlea elegans*, *Juncus confusus*, and *Allium Geyeri* extend east to South Dakota or Nebraska, *Astragalus striatus* to Minnesota, and *A. goniatus* to Hudson Bay.

c. Pacific species, which have invaded the Northern Rockies, but not the Southern

1. Species which have reached only the Selkirk-Bitterroot District

a. Forest species

The species listed here have probably followed the mountain chains in their migration from the Pacific Mountains by the way of the Cascades and the Selkirks into the Rockies.

Trees

Strobus monticola
Larix occidentalis
Abies grandis
Tsuga heterophylla
Thuja plicata
Taxus brevifolia

Shrubs

Ribes nevadense
Rubus nivalis
Rubus spectabilis
Ceanothus prostratus
Azaliastrum albiflorum
Vaccinium parvifolium
Linnaea longiflora

Herbs

Carex laeviculmis
Unifolium dilatatum
Allium validum
Disporum oreganum
Clintonia uniflora
Piperia multiflora
Piperia elegans
Lysias Menziesii
Eburophyton Austinae
Cytherea occidentalis
Corallorrhiza Mertensiana
Trautvetteria grandis
Mitellastra caulescens
Pectianthia Breweri
Therophon majus
Chimaphila Menziesii
Castilleja pinetorum

b. Water and bog plants

These have probably followed the Columbia River and Frazer River and their tributaries up into the mountains.

Shrubs or trees

Salix Lemmoni
Salix sitchensis

Herbs

Agrostis foliosa
Calamagrostis Cusickii
Graphephorum muticum
Tofieldia occidentalis
Cardamine oligosperma
Lupinus polyphyllus
Trifolium longipes
Epilobum oregonense
Epilobum glaberrimum
Dodecatheon Jeffreyi
Anthopogon simplex
Mimulus nasutus
Mimulus primuloides
Mimulus Breweri
Polystichum munitum
Isoetes Howellii
Isoetes Nuttallii

C. Various mesophytes

These have probably spread along the foothills from the Cascades to the Selkirks and Bitterroots, or even across the Columbia Plains, as most of them are also found in the Submontane or Transition Zone.

Herbs

Stipa Thurberiana
Festuca viridula
Hordeum murinum (Eur.)
Carex concinnoides
Carex spectabilis
Carex Mertensii
Eriogonum pyrolaefolium
Delphinium depauperatum
Pulsatilla occidentalis
Arabis suffrutescens
Phoenocaulis cheiranthoides
Sedum Douglasii
Heterisia Mertensiana
Dasystephana oregana
Stenotus stenophyllus
Antennaria confinis
Balsamorrhiza deltoidea
Arnica Menziesii
Cheilanthes gracillima
Selaginella Wallacei

2. SPECIES WHICH HAVE CROSSED THE MAIN RANGE OF THE ROCKIES IN MONTANA AND ALBERTA

a. Forest species

Trees

Pinus ponderosa
Apinus albicaulis

Shrubs

Ribes laxiflorum
Rubus pedatus
Acer Douglasii

Herbs

Melica subulata
Aquilegia formosa
Tiarella unifoliata
Adenocaulon bicolor
Pyrola dentata

b. Water and bog plants

Poa nervosa
Naiocrene parvifolia
Viola Macloskeyi
Trifolium Beckwithii

c. Various mesophytes

Carex Preslii
Xerophyllum tenax
Anemone Drummondii
Smelowskia ovalis
Arabis Lyallii
Lupinus laxiflorus
Phlox Douglasii
Pedicularis contorta
Arnica diversifolia

Adenocoulon bicolor reappears on Lake Superior and *Trifolium Beckwithii* in eastern South Dakota.

3. SPECIES WHICH HAVE REACHED THE YELLOWSTONE PARK

a. Forest species

Calamagrostis Suksdorfii
Hypericum Scouleri
Ozmorrhiza brevipes
Kelloggia galioides
Aster integrifolius
Antennaria racemosa

b. Bog plants

Shrub

Salix Austinae

Herbs

Panicum thermale
Tofieldia intermedia
Juncus nevadensis
Alsine crispa
Ranunculus alismellus
Cardamine Breweri

c. Mesophytes

Stipa Elmeri
Stipa oregonensis
Calamagrostis rubescens
Carex Jonesii
Carex nervina
Carex luzulina
Potentilla Blaschkeana
Potentilla glomerata
Fragaria platypetala
Dasystephana calycosa
Townsendia scapigera‡
Balsamorrhiza terebinthacea‡

4. SPECIES WHOSE DISTRIBUTION EXTENDS EVEN INTO THE UINTAH AND WASATCH MOUNTAINS OF UTAH

a. Forest species

Shrubs

Vaccinium occidentale — *Sambucus coerulea*

Herbs

Aquilegia flavescens — *Apocynum pumilum*
Bicuculla uniflora

b. Water and bog plants

Shrub

Ledum glandulosum

Herbs

Ruppia pectinata — *Alsinopsis occidentalis*
Limnia asarifolia — *Alsine brachypetala*
Limnia sibirica (Asia) — *Dodecatheon alpinum*
Limnia perfoliata — *Aster oreganus*

c. Mesophytes

Agrostis Thurberiana — *Arabis Lemmonii*
Arenaria Douglasii — *Lupinus leucophyllus*
Thalictrum occidentale — *Gayophytum diffusum*
Paeonia Brownii — *Gayophytum pumilum*
Thlaspi californicum — *Lappula diffusa*
Draba oligosperma

D. PLANTS COMMON TO THE NORTHERN ROCKIES AND THE CASCADES, BUT NOT FOUND IN THE SOUTHERN ROCKIES OR IN SIERRA NEVADA

1. SPECIES FOUND AS FAR SOUTH AS THE YELLOWSTONE PARK REGION

a. Forest shrubs

Spiraea densiflora — *Menziesia ferruginea*
Spiraea lucida — *Menziesia glabella*

b. Bog plants

Shrubs

Salix idahoensis
Salix Geyeriana
Alnus sinuata

Herbs

Agrostis oregonensis
Carex Piperi
Carex microptera
Caltha leptosepala
Lupinus Burkei
Epilobium delicatum
Angelica Lyallii
Dodecatheon conjugens
Aster Jessicae
Senecio subnudus
Botrychium Coulteri

c. Various mesophytes

Sitanion montaum
Elymus nitidus
Carex Tolmei
Eriogonum Piperi
Spraguea multiceps
Silene Lyallii
Silene oregana
Silene multicaulis
Thalictrum columbianum
Delphinium Nuttallianum
Arabis albertina
Lupinus leucopsis
Lupinus sericeus
Cordylophorum suffruticosum
Amarella anisosepala
Dasystephana monticola
Pentstemon crassifolius
Castilleja pallescens
Valeriana ceratophylla
Aster conspicuus
Antennaria flagellaris
Antennaria Howellii
Artemisia floccosa
Arnica gracilis
Senecio Howellii
Hieracium cynoglossoides

Lupinus sericeus and *Aster conspicuus* extend east to the Black Hills.

2. SPECIES WHOSE RANGE EXTENDS EVEN INTO THE UINTAH-WASATCH REGION

Juncus Regelii
Silene columbiana
Ranunculus limosus
Delphinium bicolor
Arabis rupestris
Arabis microphylla
Potentilla dichroa
Castilleja Tweedyi
Eucephalus elegans
Hieracium albertinum
Hieracium griseus
Gnaphalium proximum

3. SPECIES FOUND IN THE MAIN RANGE IN MONTANA AND ALBERTA BUT NOT FARTHER SOUTH

Shrubs

Salix Fernaldii
Philadelphus Lewisii
Ribes petiolare
Rosa nutkana
Sorbus occidentalis
Vaccinium globulare
Luetkea pectinata

Herbs

Poa Vaseyochloa
Xerophyllum Douglasii
Juncoides glabratum
Erythronium grandiflorum
Eriogonum polyphyllum
Eriogonum depressum
Arenaria nardifolia (Asia)
Silene repens (Asia)
Atragene grosseserrata
Arabis Nuttallii
Arabis furcata
Heuchera glabra
Heuchera grossulariifolia
Micranthes aestivalis
Potentilla Drummondii
Epilobium luteum
Viola orbiculata
Valeriana Scouleri
Penstemon Lyallii
Dodecatheon cylindrocarpum
Dodecatheon viviparum
Castilleja Suksdorfii
Castilleja lutea
Antennaria Howellii
Antennaria luzuloides
Erigeron Howellii
Aster modestus
Aster diabolicus
Aster Sayianus
Achillea fusca
Cirsium Macounii
Selaginella montanensis

4. CASCADE MOUNTAIN SPECIES WHICH HAVE EMIGRATED INTO THE SELKIRK-BITTERROOT REGION

Shrub

Salix commutata

Herbs

Alopecurus pallescens
Poa Cusickii
Agropyron lanceolatum
Elymus Howellii
Carex stenochlaena
Allium fibrillum
*Allium Cusickii**
Eriogonum thymoides
Claytonia chrysantha
Alsine washingtoniana
Arenaria cephaloidea
Aquilegia columbiana
Sedum Leibergii
Hemieva ranunculifolia

Aruncus acuminatus
Trifolium plumosum
Angelica Piperi
Osmorrhiza Leibergii
Osmorrhiza purpurea
Ligusticum Canbyi
Ligusticum Leibergii
Chamaepericlymenum unalaschense
Moneses reticulata
Pyrola bracteata
Oxycoccus intermedius
Pentstemon pinetorum
Veronica Cusickii
Synthyris major
Castilleja cervina
Razoumofskya Laricis
Valeriana sitchensis
Castilleja Vreelandii
Aster Cusickii
Balsamorrhiza Careyana
Saussurea americana
Lactuca multifida
Polystichum Andersoni
Thelypteris Oreopteris (Eur.)

E. Plants common to the Southern Rockies and the Sierra Nevada

These plants have spread across the Great Basin, their seed being carried by birds or wind from mountain to mountain by way of the numerous though low parallel mountain chains within the Basin. Most of them are xerophytic, the rest mesophytic. Species in the following list marked "††" extend into the Submontane Zone; those marked "‡‡" are not found east of the Wasatch Mountains.

Trees

Pinus aristata
Abies concolor

Herbs

Elymus simplex††
Stipa speciosa‡‡††
Oryzopsis Webberi††
Muhlenbergia gracilis††
Poa Fendleriana
Carex fissuricola‡‡
Carex epapillosa‡‡
Rumex hymenosepalus††
Amaranthus Powellii
Quamoclidion multiflorum††
Oreobroma nevadensis
Erocallis triphylla
Alsine Jamesii
Lepidium montanum††
Heuchera rubescens‡‡††
Sericotheca glabrescens‡‡††
Drymocallis pumila‡‡
Trifolium Rusbyi‡‡
Phaca Hookeriana‡‡††
Hamosa calycosa‡‡††
Kentrophyta tegetaria‡‡
Hypericum formosum††

Viola Beckwithii‡‡
Viola Sheltoni
Microsteris micrantha††
Hydrophyllum alpestre‡‡
Macronema discoideum
Dugaldia Hoopesii††
Senecio filicifolius‡‡††
Polystichum scopulinum‡‡
Selaginella Watsoni‡‡
Selaginella Underwoodii

IV. **Endemic Rocky Mountain species**

As the endemic element of the montane plants is very large, consisting of about 1040 species, or over 53 per cent of the whole number, it is hardly practicable to list them all. I shall therefore merely give the number of species found in each category and mention specifically only a few in each class whose distribution is particularly characteristic or of special interest.

A. Endemic plants common to the Southern and Northern Rockies

Many of the endemic plants are of wide distribution, their range extending from Colorado or northern New Mexico to Montana or even further north. To this category belong the following trees: *Pinus scopulorum*, *Populus angustifolia*, *Betula fontinalis*, and six species of *Salix* (three of these usually mere shrubs). Among the shrubs, *Sambucus melanocarpa*, *Ceanothus velutinus*, and *Svida instolonea* are the most common and most widely distributed. The category contains 6 trees, 12 shrubs, and 217 herbs, and if to these are added 7 grasses and 6 other herbs belonging to the plains and occasionally reaching the Montane Zone, the whole number of species is 248. Of these some extend outside of the Rocky Mountains, as for instance *Svida instolonea*, which reaches to Manitoba and Kansas, *Drymocallis fissa* the Black Hills, and *Scrophularia occidentalis* North Dakota and Oklohoma.

B. Plants endemic to the Southern Rockies only

1. Plants found both in the Main Range and in the Uintah-Wasatch region

To this category belong two trees, *Picea pungens* and *Populus Wislizenii*, together with 13 shrubs and 197 herbs, or in all 212 species. Of these some are limited to the very southern slope of

the Rockies and are in reality immigrants from the Upper Sonoran region, as for instance, *Populus Wislizenii*, *Grossularia leptantha*, *Blepharoneuron tricholepis*, *Calamagrostis scopulorum*, *Festuca arizonica* and *Fragaria ovalis*.

As I have stated elsewhere, the interchange of flora between the Southern Rockies and the Northern does not take place so much along the continental divide in central Wyoming as from the Wasatch Mountains, over the Bear River Mountains and the Tetons, to the Northern Rockies. Several southern species are found in the two intermediate ranges mentioned and several northern ones in the Wasatch. These southern species are as follows:

Shrub

Salix Wolfii

Herbs

Stipa Vaseyi
Rumex densiflorus
Ranunculus intertextus
Delphinium occidentale
Delphinium reticulatum
Cardamine cordifolia
Arabis divaricarpa
Potentilla filicaulis
Sidalcea neomexicana
Amarella monantha
Primula Parryi
Orthocarpus purpureo-albus
Penstemon subglaber
Penstemon Rydbergii
Aster Canbyi
Senecio perplexus
Senecio rapifolius
Senecio uintahensis
Cirsium Eatoni
Leontodon scopulorum

The following plants of the Southern Rockies extend into the Black Hills or western Nebraska.

Poa andina
Eriogonum pauciflorum
Arabis Fendleri
Draba auriformis
Saxifraga simulata
Potentilla propinqua
Opulaster monogynus
Ceanothus Fendleri
Cynomarathrum Nuttallii
Dodecatheon radicatum
Sambucus microbotrys
Thelesperma gracilis
Senecio spartioides
Senecio rapifolius

2. PLANTS FOUND IN THE MAIN RANGE BUT NOT IN THE UINTAH-WASATCH REGION

To this category belong nearly half of the endemic plants of the Southern Rockies. The list comprises 6 shrubs and 252 herbs, but no trees. Some of these are restricted to the southern slope only and may be considered as immigrants from the Upper Sonoran region. Among these are three of the four fernworts endemic to the Southern Rockies: *Cheilanthes Fendleri*, *Notholaena Fendleri*, and *Selaginella mutica*. A fourth fern, *Woodsia mexicana*, is also found in the Black Hills and in Minnesota, and ranges southward into Mexico.

3. PLANTS RESTRICTED TO THE UINTAH-WASATCH REGION

This category comprises 7 shrubs and 71 herbs, but no trees. Many of these plants are also found in the mountains of the Great Basin. Some of them, as *Fendlerella utahensis*, *Chamaebatiaria Millefolium*, *Arctostaphylos platyphylla*, *Phaca serpens*, and *Phaca Sileriana* are evidently immigrants from the Upper Sonoran region.

There are 47 local endemics found in Wyoming and southeastern Idaho which occur nowhere else in the Rockies. Of these maybe one third should be counted as belonging to the southern Rockies. If so, the total number of endemics restricted to the southern Rockies would be about 560 species.

C. PLANTS ENDEMIC TO THE NORTHERN ROCKIES ONLY

1. PLANTS OF GENERAL DISTRIBUTION WITHIN THE NORTHERN ROCKIES

Fully one-third of the endemic species of the Northern Rockies are of general distribution and extend as far south as the Yellowstone Park Region. Among these are included two trees, *Picea albertiana* and *Betula utahensis*, 4 shrubs and 102 herbs; altogether 108 species. Of these the following extend south into the Uintah-Wasatch region.

Juncus Tweedyi
Cardamine multifolia
Ranunculus saxicola
Delphinium bicolor
Aconitum divaricatum
Draba andina

Arabis oreophila
Arabis exilis
Micranthes Greenei
Potentilla ovina
Drymocallis foliosa
Trifolium scariosum
Angelica Roseana
Dodecatheon salinum‡
Swertia congesta
Synthyris laciniata
Orthocarpus Tolmiei
Aster amplifolius
Machaeranthera viscosa
Erigeron tenellum
Arnica arcana

The following reach the Black Hills:

Alsinopsis dawsonensis
Atelophragma glabriuscula
Atelophragma Forwoodii
Homalobus dispar
Aragallus villosus
Aragallus gracilis
Aragallus spicatus‡
Aster meritus
Cirsium Drummondii

2. SPECIES FOUND IN MONTANA AND NORTHERN IDAHO AND NORTHWARD

This category contains one tree, *Betula subcordata*, two shrubs (*Vaccinium* sp.), and 31 herbs; altogether 34 species. Of these, *Aragallus splendens* extends eastward to Minnesota, *Vaccinium membranaceum* to upper Michigan, and *V. ovalifolium* to the Gaspé Peninsula.

3. LOCAL SPECIES OR SPECIES OF VERY RESTRICTED RANGE

The local species of Wyoming and eastern Idaho number 47 (of which perhaps one third should be accredited to the Southern Rockies while 6 are also found in the Uintahs or Wasatchs), those of Montana 19, those of western Idaho 14, those of the Black Hills 5, and those of the Canadian Rockies 22 (among the latter one tree, *Betula alaskana*, and three shrubs); in all, 107 local species. If all categories of endemic species are considered, the number restricted to the Northern Rockies includes altogether about 230 species, and the number endemic to the Rocky Mountains as a whole 1,040 species.

SUMMARY

Within the Montane Zone in the Rocky Mountains are found about 1900 species. Of these, approximately 50 per cent* are

* All percentage figures in the following paragraphs are computed with reference to the total number of species.

Montane plants in the restricted sense, i. e. plants which attain their best development within this zone. Of the rest, many reach their best development in the Subalpine Zone above, and many others in the Submontane Zone below. A few alpine plants are sometimes found as low as the Montane Zone and several species from the Great Plains or from the Sonoran Zone are occasionally found as high up.

Of the plants found in the Montane Zone, 245, or less than 13 per cent, are transcontinental, i. e. they are found both in the East and on the Pacific Slope, as well as in the Rockies; 176 of these, or 9 per cent of the total flora, are common to the Northern and Southern Rockies, another 1 per cent extend as far south as Wyoming, and 1 per cent are limited to the Canadian Rockies.

Besides the transcontinental plants, there are 84 species which are common to the East and the Rockies but have not reached the Pacific Slope. If to these are added a score of western plants which have emigrated eastward as far as the Great Lakes and Hudson Bay, some of them even to the Gaspé Peninsula, Quebec, there are in all about 350 species, or nearly 18½ per cent of the flora, which are common to the East and to the Rockies. The larger portion of these, 250 species or over 13 per cent, are found in both the Northern and Southern Rockies, and 100, or more than 5 per cent, in the Northern only. None of the Montane plants are common to the East and the Southern Rockies only.

The number of species common to the Rockies and the Pacific Mountains is much larger: if the transcontinental species are excluded, about 565, or nearly 30 per cent; or, if these are included nearly 43 per cent of all the plants found within the Montane Zone of the Rockies. Nearly 450 of the plants common to the Rockies and the Pacific Mountains (the transcontinental ones included), or nearly 24 per cent of the whole number are found in both the Northern and Southern Rockies; 350, or about 18 per cent, are found in the Northern Rockies but not in the Southern, and not quite 2 per cent occur in the Southern but not in the Northern Rockies. Of the species common to the Rockies and the Pacific Mountains (the transcontinental ones not included), about 300, or nearly 16 per cent, are found both in the Cascades and the Sierra Nevada; about 225, or nearly 12 per cent, are found in the

Cascades alone, and less than 2 per cent in the Sierra Nevada alone. If the transcontinental plants are added, the percentage for the plants found in both the Sierras and the Cascades and for those found in the Cascades alone would be increased to about 20 per cent of each. The ratio for those found in the Sierras alone would remain less than 2 per cent. This refers of course to the Montane plants only. In the Submontane region the ratio would be much greater.

The endemic element consists of 1,040 Montane plants or over 53 per cent of the whole number. Of these, 245 or nearly 13 per cent are common to the Northern and Southern Rockies, 560 or nearly 29 per cent being restricted to the Southern Rockies, and 230 or 12 per cent to the Northern. Of the latter about 10 per cent extend as far south as Northern Wyoming and 1 per cent are restricted to the Canadian Rockies. Of the species restricted to the Southern Rockies over 11 per cent are common to the Main Range in Wyoming, Colorado, and New Mexico and the Uintah-Wasatch region, while 13½ per cent are restricted to the former and nearly 4 per cent to the latter. Of those restricted to the Northern Rockies, 8 per cent are found in Northern Wyoming and a little over 1 per cent are restricted to the Canadian Rockies. If the flora of the Canadian Rockies were better known this latter number probably would be much larger. We must also remember that only the region south of latitude 55° is here considered.

It may also be of interest to see how the number of species found in the Southern and Northern Rockies would compare, if all categories of Montane plants are taken in consideration. There are over 40 per cent common to both, nearly 28 per cent restricted to the Southern Rockies and 32 per cent to the Northern. The species found in the Southern but not in the Northern Rockies consist almost wholly of endemic forms, less than 2 per cent being common to the Southern Rockies (and most of these found only in Utah) and the Sierra Nevada and 3 species only being Eastern nontranscontinentals. Those found in the Northern Rockies and not in the Southern consist of over 3 per cent transcontinental species, less than 2 per cent being common to the Northern Rockies and the Eastern Canadian Zone, nearly 15 per cent common to the former and the Pacific Mountains and 12 per cent endemics: altogether 32 per cent of all Montane species.

As stated before, the interchange of species between the two great divisions of the Rockies has taken place from the northern part of the Wasatch Mountains over the Bear River Mountains and the Teton Mountains to the Northern Rockies, or vice versa, rather than along the continental divide in central Wyoming. Among the Montane plants, I have listed 69 northern species, or over 3½ per cent of the total flora, which are found in the Wasatchs but nowhere else in the Southern Rockies, and 23 Southern species, or over 1 per cent, which are found in southern Idaho or in the Teton Mountains, and nowhere else in the Northern Rockies.

A good deal could also be said about the distribution of the plants in the Black Hills, a meeting place of plants from the Northern Rockies, the Southern Rockies, the Canadian and Alleghanian Zones of the East, and of the flora of the Great Plains, and I hope to take up this subject at some future time.

NEW YORK BOTANICAL GARDEN

INDEX TO AMERICAN BOTANICAL LITERATURE

1917–1919

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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Andrews, A. L. Bryological notes—V. *Scapania nimbosa* from Norway. Torreya **19**: 49–51. 14 My 1919.

Andrews, E. F. The Japanese honeysuckle in the eastern United States. Torreya **19**: 37–43. *f. 1, 2.* 14 My 1919.

Arthur, J. C. New names for species of Phanerogams. Torreya **19**: 48, 49. 14 My 1919.

Arthur, J. C. New species of Uredineae—XI. Bull. Torrey Club **46**: 107–125. 1 My 1919.

New species are described in *Puccinia* (8), *Uredo* (3), and *Aecidium* (5).

Arthur, J. C. Research as a university function. Science II. **49**: 387–391. 25 Ap 1919.

Beardslee, H. C. A new species of *Amanita*. Jour. Elisha Mitchell Soc. **34**: 198, 199. *pl. 30, 31.* Mr 1919.

Amanita mutabilis sp nov.

Berg, A. A simple method of distinguishing nematode galls of wheat from bunted kernels. Phytopathology **9**: 181, 182. *f. 1.* 2 Ap 1919.

Berry, E. W. Geologic history of the locust and its allies. Plant World **21**: 284–298. *f. 1, 2.* N 1918.

Blakeslee, A. F. & Avery, B. T. Mutations in the jimson weed. Jour. Heredity **10**: 111–120. *f. 5–15.* 25 Ap 1919.

Butler, A. E. Notes by a collector in the Colorado Rockies. Nat. Hist. **19**: 170–181. Mr 1919. [Illust.]

Bouquet, A. G. B. Pollination of tomatoes. Oregon Agr. Exp. Sta. Bull. 157; 1–29. *f. 1–5*. Mr 1919.

Brown, F. B. H. The preparation and treatment of woods for microscopic study. Bull. Torrey Club **46**: 127–150. *f. 1–6*. 1 My 1919.

Chamberlain, E. B. *Anacamptodon splachnoides* var. *Tayloriae* in Missouri. Bryologist **22**: 16. 30 Ap 1919.

Chamberlain, C. J. The living cycads. i–xiv+1–172. *f. 1–91*. Chicago. 30 Ap 1919.

Clokey, I. W. *Carex* notes. Rhodora **21**: 83–85. 9 My 1919.
Includes *Carex arapahoensis* and *C. subimpressa*, spp. nov.

Coit, J. E., & Hodgson, R. W. An investigation of the abnormal shedding of young fruits of the Washington navel orange. Univ. Calif. Pub. Agr. Sci. **3**: 283–368. *pl. 25–42+f. 1–9*. 4 Ap 1919.

Coker, W. C. The Hydnums of North Carolina. Jour. Elisha Mitchell Soc. **34**: 163–197. *pl. 1–29*. Mr 1919.
Hydnellum ferrugipes, *H. carolinianum* and *Phellodon Cokeri* Banker, spp. nov., are described.

Collins, F. S. The green algae of North America, second supplementary paper. Tufts College Stud. 4^7: 1–106. *pl. 1–3*. 1 Je 1918.

Collins, F. S. A working key to the genera of North American algae. Tufts College Stud. 4^8: 1–50. N 1918.

Coulter, J. M. The botanical opportunity. Science II. **49**: 363–367. 18 Ap 1919.

Cox, P. *Dirca palustris* L. in New Brunswick. Ottawa Nat. **32**: 170. Mr 1919.

Davis, J. J. North American Ascochytae. Trans. Wisconsin Acad. Sci. **19**: 655–670. 1919.

Davis, J. J. Notes on parasitic fungi in Wisconsin—IV. Trans. Wisconsin Acad. Sci. **19**: 671–689. 1919;—V. 690–704. 1919; —VI. 705–727. 1919. [Illust.]
Twenty-three new species in various genera are described.

Deatrick, E. P. The effect of manganese compounds on soils and plants. Cornell Agr. Exp. Sta. Mem. 19: 371–402. F 1919.

Durfee, T. Lichens of the Mt. Monadnock region, N. H.—No. 11. Bryologist **22**: 15, 16. 30 Ap 1919.

Durand, E. J. *Encalypta laciniata* in central New York. Bryologist **22**: 13. 30 Ap 1919.

Ensign, M. R. A staining method for vascular tissue. Phytopathology **9**: 180. 2 Ap 1919.

Ensign, M. R. Sweet potato mosaic. Phytopathology **9**: 180, 181. 2 Ap 1919.

Fairchild, D. Present condition and opportunity of the American Genetic Association. Jour. Heredity **10**: 65–67. 5 Ap 1919.

Farwell, O. A. *Bromelica* (Thurber): a new genus of grasses. Rhodora **21**: 76–78. 9 My 1919.

Fernald, M. L. Lithological factors limiting the ranges of *Pinus Banksiana* and *Thuja occidentalis*. Rhodora **21**: 41–67. 14 Ap 1919. [Illust.]

Fitzpatrick, H. M. George Francis Atkinson. Science II. **49**: 371, 372. 18 Ap 1919.

Fromme, F. D. Cedar rust. Virginia Hort. Soc. Ann. Rep. **23**: 1–11. 1918.

Fromme, F. D., & Wingard, S. A. Bean rust: its control through the use of resistant varieties. Virginia Agr. Exp. Sta. Bull. 220: 1–18. *pl. 1–5*. N 1918.

Giddings, N. J. Infection and immunity in apple rust. West Virginia Agr. Exp. Sta. Tech. Bull. 170: 1–71. *pl. 1–11*. D 1918.

Gould, H. P. Fig growing in the South Atlantic and Gulf states. U. S. Dep. Agr. Farm. Bull. 1031: 1–45. *f. 1–24*. Mr 1919.

Gray, J., & Peirce, G. J. The influence of light upon the action of stomata and its relation to transpiration of certain grains. Am. Jour. Bot. **6**: 131–155. *f. 1–18*. 1 My 1919.

[Greenman, J. M.] Early collections in the Garden Herbarium. Missouri Bot. Gard. Bull. **7**: 29–35. *pl. 8–11*. Mr 1919.

[Greenman, J. M.] Plants in the aroid house. Missouri Bot. Gard. Bull. **7**: 35–38. *pl. 7*. Mr 1919.

Harper, R. M. Some vanishing scenic features of the southeastern United States. Nat. Hist. **19**: 193–204. F 1919. [Illust.].

Hayes, H. K., & Stakman, E. C. Rust resistance in timothy. Jour. Am. Soc. Agron. **11**: 67–70. F 1919.

Hoagland, D. R. Note on the technique of solution culture experiments with plants. Science II. **49**: 360–362. 11 Ap 1919.

Haas, A. R. C. Respiration after death. Bot. Gaz. **67**: 347–365. *f. 1–3*. 18 Ap 1919.

Hottes, A. C. Commercial plant propagation. 1–180. *f. 1–105*. New York. 1918.

Howe, M. A. Dahlias and their culture. Jour. Hort. Soc. New York **11**: 285–301. *pl. 45+f. 1–3.* F 1919.

Reprinted abridged and with substitute illustrations in Gard. Chron. Am. **23**: 152–154. My 1919.

Johnson, A. T. *Arbutus Menziesii.* The Garden **83**: 124. 15 Mr 1919.

Johnson, J., & Milton, R. H. Strains of white burley tobacco, resistant to root-rot. U. S. Dept. Agr. Bull. 765: 1–11. *f. 1–4.* 18 Ap 1919.

Jones, L. R. Our journal, Phytopathology. Phytopathology **9**: 159–164. 2 Ap 1919.

Lee, H. A. Plant pathology in Japan. Phytopathology **9**: 178, 179. 2 Ap 1919.

Leighty, C. E., & Hutcheson, T. B. On the blooming and fertilization of wheat flowers. Jour. Am. Soc. Agron. **11**: 143–162. *f. 11, 12.* Ap 1919.

Lloyd, F. E. The origin and nature of the mucilage in the cacti and in certain other plants. Am. Jour. Bot. **6**: 156–166. 1 My 1919.

Love, H. H., & Craig, W. T. The synthetic production of wild wheat forms. Jour. Heredity **10**: 51–64. *f. 1–9+frontispiece.* 5 Ap 1919.

Lowe, R. L. Collecting in Arkansas. Bryologist **22**: 14, 15. 30 Ap 1919.

Lyman, G. R. The unification of American botany. Science II. **49**: 339–345. 11 Ap 1919.

Lyon, T. L. Influence of higher plants on bacterial activities in soils. Jour. Am. Soc. Agron. **10**: 313–322. D 1918.

MacMillan, H. G. *Fusarium*-blight of potatoes under irrigation. Jour. Agr. Research **16**: 279–303. *pl. 37–41.* 17 Mr 1919.

Macoun, J. M. Habitat of *Carex Franklinii* Boott. Ottawa Nat. **32**: 169. Mr 1919.

Martin, J. N. Botany for agricultural students. i–x+1–585. *f. 1–488.* New York. 1919.

McClelland, T. B. Vanilla: a promising new crop for Porto Rico. Porto Rico Agr. Exp. Sta. Bull. 26: 1–32. *pl. 1–3+f. 1–4.* 17 Ap 1919.

Moore, G. T. Botanical participation in war work. Science II. **49**: 269–274. 21 Mr 1919.

Murrill, W. A. The natural history of Staunton, Virginia. i–xiii+1–266. *pl. 1–4.* New York. 1919.

Nichols, G. E. *Lophiola aurea* in Nova Scotia. Rhodora **21**: 68. 14 Ap 1919.

Nichols, G. E. Raised bogs in eastern Maine. Geog. Rev. **7**: 159–167. *f. 1, 2.* Mr 1919.

Orton, C. R., & Kern, F. D. The potato wart disease. Pennsylvania Agr. Exp. Sta. Bull. 156: 1–16. *f. 1–4.* Mr 1919.

Pennell, F. W. *Eysenhardtia.* N. Am. Fl. **24**: 34–40. 25 Ap 1919.
Seven new species are described.

Piper, C. V. New Pacific coast plants. Proc. Biol. Soc. Washington **32**: 41–44. 11 Ap 1919.
Includes *Cryptantha suffruticosa, Sidalcea nelsoniana, Stachys caurina, S. confertiflora, S. ciliata macrantha, Penstemon deserticola,* and *Circium oreganum,* spp. nov.

Popenoe, W. The avacado in Guatemala. U. S. Dept. Agr. Bull. 743: 1–69. *pl. 1–23.* 17 Ap 1919.

Pomeroy, C. S. Bud variations in sugar cane. Jour. Heredity **10**: 129–135. *f. 16, 17.* 25 Ap 1919.

Reed, H. S., & Holland, R. H. The growth rate of an annual plant *Helianthus.* Proc. Nat. Acad. Sci. **5**: 135–144. *f. 1–3.* Ap 1919.

Roberts, H. F. The founders of the art of breeding. Jour. Heredity **10**: 99–106. *f. 1–4.* 25 Ap 1919; II. Jour. Heredity **10**: 147–152. *f. 1 + frontispiece.* 26 My 1919; III. Jour. Heredity **10**: 229–239. *f. 1–20.* 15 Jl 1919.

Robinson, B. L. An unusual *Daucus Carota.* Rhodora **21**: 70, 71. 14 Ap 1919.

Rock, J. F. A monographic study of the Hawaiian species of the tribe Lobelioideae family Campanulaceae. i–xvi+1–394. *pl. 1–217.* 1919.
Includes new species in *Lobelia* (4) and *Cyanea* (2).

Rolfe, R. A. *Govenia lagenophora.* Curt. Bot. Mag. IV. **15**: *pl. 8794.* Mr 1919.
A plant from Mexico.

Rolfe, R. A. *Isabelia virginalis.* Curt. Bot. Mag. IV. **15**: *pl. 8787.* Mr 1919.
A plant from Brazil.

Rose, R. C. After-ripening and germination of seeds of *Tilia, Sambucus,* and *Rubus.* Bot. Gaz. **67**: 281–308. 18 Ap 1919.

Rosendahl, C. O. Variations in the flowers of *Erythronium propullans* Gray. Torreya **19**: 43–47. *f. 1–3.* 14 My 1919.

Rowlee, W. W. Synopsis of the genus *Ochroma,* with descriptions of new species. Jour. Washington Acad. Sci. **9**: 157–167. 19 Mr 1919.
Six new species are described.

Rydberg, P. A. Key to the Rocky Mountain Flora. 1–305. New York. 1919. i–xiii+1–216. *pl. 1–4.* 1919.

Rydberg, P. A. (Rosales) Fabaceae. Psoraleae. N. Am. Fl. **24**: 1–64. 25 Ap 1919.

Includes *Hoita, Rhytidomene, Psoralidium, Pediomelum, Psorobatus, Psorodendron, Psorothamnus*, gen. nov., and new species in *Hoita* (4), *Psoralidium* (1), *Pediomelum* (7), *Amorpha* (5), *Psorodendron* (2), *Psorothamnus* (4), and *Parosela* (8).

Schneider, C. Notes on American willows—IV. Species and varieties of section *longifoliae*. Bot. Gaz. **67**: 309–346. 18 Ap 1919.

Several new varieties are described.

Shear, C. L. First decade of the American Phytopathological Society. Phytopathology **9**: 165–170. 2 Ap 1919.

Shufeldt, R. W. Mandrakes, wild lupine, and notes on American snapping turtle. Am. Forestry **25**: 995–1000. *f. 1–9*. Ap 1919.

Skinner, J. J., & Reid, F. R. The influence of phosphates on the action of alpha-crotonic acid on plants. Am. Jour. Bot. **6**: 167–180. *f. 1–9*. 1 My 1919.

Smith, G. M. A second list of algae found in Wisconsin lakes. Trans. Wisconsin Acad. Sci. **19**: 614–654. *pl. 10–15*. 1918.

Includes the new genus *Planktosphaeria* and new species in *Planktosphaeria* (1), *Asterococcus* (1), *Oocystis* (1), *Tetraedron* (1), *Characium* (1), and *Chlorolotrys* (1).

Stakman, E. C., Levine M. N., & Leach, J. G. New biologic forms of *Puccinia graminis*. Jour. Agr. Research **16**: 103–105. 20 Ja 1919.

Standley, P. C. A neglected *Solidago* name. Rhodora **21**: 69, 70. 14 Ap 1919.

Stevens, N. E. Keeping quality of strawberries in relation to their temperature when picked. Phytopathology **9**: 171–177. 2 Ap 1919.

Stevenson, J. A. A check list of Porto Rican fungi and a host index. Jour. Dept. Agr. Porto Rico. *2*: 125–264. Jl 1918.

Stout, A. B. Bud variation. Proc. Nat. Acad. Sci. **5**: 130–134. *f. 18*. Ap 1919.

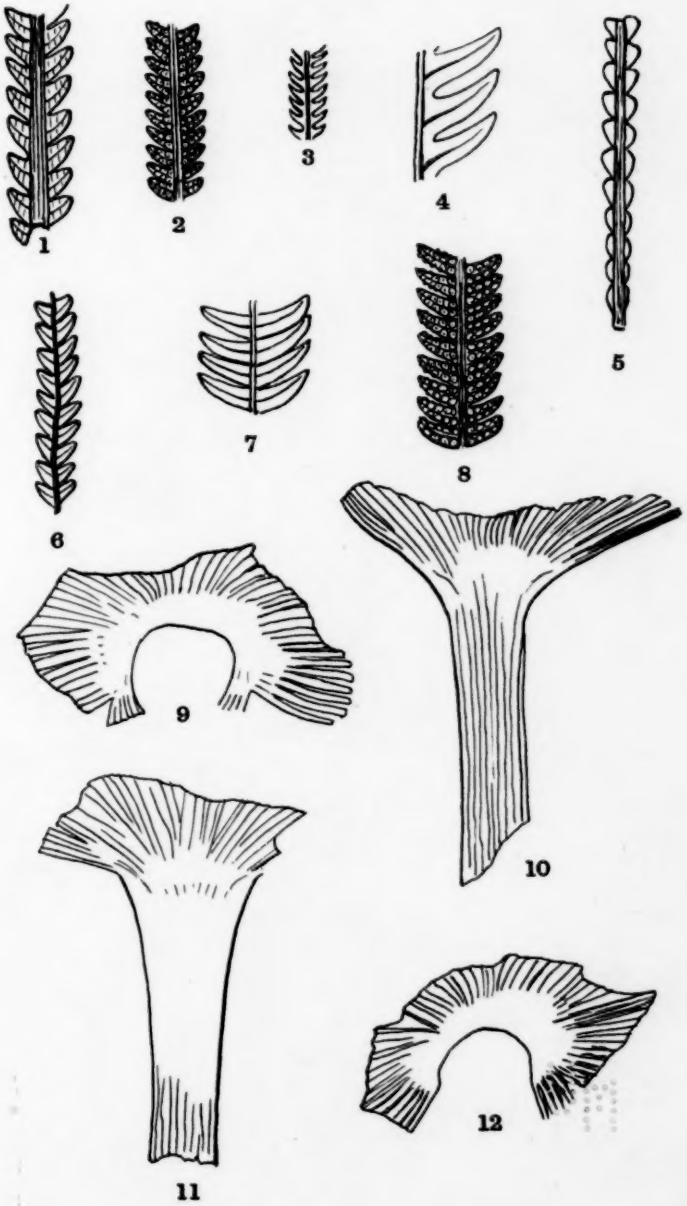
Tisdale, W. H. *Physoderma* disease of corn. Jour. Agr. Research **16**: 137–154. *pl. A, B, 10–17* + *f. 1*. 3 F 1919.

Tottingham, W. E. A preliminary study of the influence of chlorides on the growth of certain agricultural plants. Jour. Am. Soc. Agron. **11**: 1–32. Ja 1919.

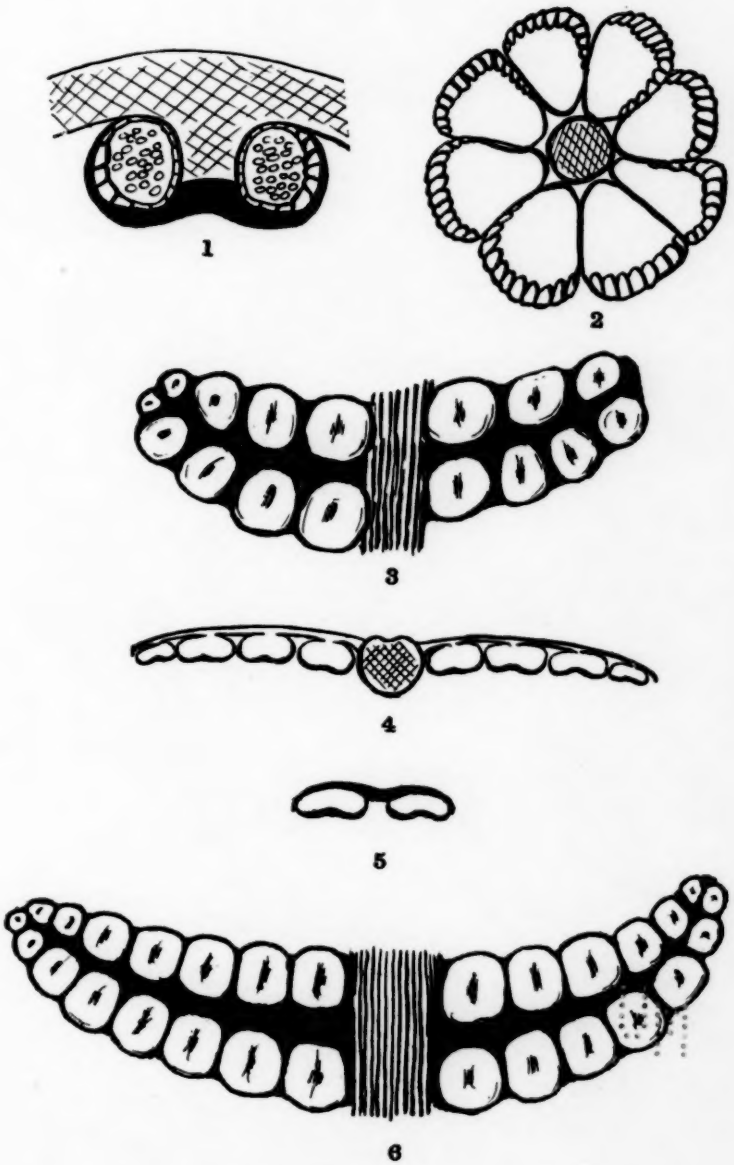
Transeau, E. N., & Tiffany, H. New Oedogoniaceae. Ohio. Jour. Sci. **19**: 240–242. *pl. 14*. F 1919.

O. hystricinum and *Bulbochaete Bullardi*, spp. nov., are described.

Van Fleet, W. New everbearing strawberries. Jour. Heredity **10**: 14–16. *f. 6, 7*. 8 Mr 1919.



MATONIDIUM AMERICANUM BERRY



1, 2. MATONIA PECTINATA R.Br.
3–6. MATONIDIUM AMERICANUM Berry